

The Chemical Sector

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Chemicals are everywhere in society - plastics, clothing, computers, glues, paints, tyres, fertilizer, cosmetics, toothpaste, explosives and thousands of applications that most consumers never see or think about. Which sector of the economy does not use chemicals? They all do. They are also key to renewable power generation.

Chemicals are the hidden enablers of economic development, the “lubricants” that make modern economic activity possible.

“The whole megatrend with respect to urbanisation, population growth and expansion of the middle class really points to growth in chemicals” (Sasol CEO Fleetwood Grobler (Financial Times, 2020)). Global demand for plastics has grown faster than any other group of bulk materials.

Employment is not in the capital intensive chemical sector itself, but in the other economic activities that it enables. Less than 10 000 people (SAPIA, 2018) produce 80% of South Africa’s (SA) liquid fuels, which have a sales value 40% larger than electricity.

Constraints

Petrochemicals are the biggest and most important group of chemicals and are conventionally made from oil and natural gas. Petrochemicals thrive in integrated clusters. Unfortunately, SA’s oil refineries are small, ageing and spread across the country.

Typically, an oil refinery has a naphtha cracker attached to it which produces the seven basic petrochemical building blocks (ethylene, propylene, butadiene, benzene, toluene, xylene and methanol). SA had this until Sasol Secunda was built (late 1970s early 1980s for strategic reasons) and the naphtha cracker was closed. Sasol’s coal-to-liquids technology does not produce the full slate of petrochemicals. The ones that it does produce are in proportions that are the inverse of the global norm. This inverse proportion phenomena makes it very difficult for local competitors to challenge

Sasol’s monopoly. Forty years later, SA is still stuck in this petrochemicals cul-de-sac. There seems to be no way out using conventional technologies until manufacturing is substantially larger.

In petrochemicals, the keys to success are low feedstock costs plus good technologies. SA has no conventional feedstocks (oil and gas). In today’s markets, it is doubtful if a conventional crude oil-based naphtha cracker in SA would be competitive given the low feedstock costs in the Organisation of the Petroleum Exporting Countries (OPEC).

The exception may be imported liquefied natural gas (LNG) to petrochemicals for Sasol (Cameron, 2020), presumably based on its depreciated plant and its low cash costs for coal-based liquid fuels (35\$/bbl (McKay, 2019)).

Secunda is under threat from declining gas reserves in Mozambique (said to end in 2025) and carbon taxes. The prospect of Secunda closing, or substantial parts of it, may be within sight. That would be a serious blow to the SA economy. Sasol is the largest firm on the Johannesburg stock exchange (JSE), contributing approximately 20% of liquid fuels supply, and is the only source of petrochemicals.

There are no other immediate feedstock options in SA. Total’s Brulpadda gas find is at least 7 to 10 years away from commercialisation and even then it may not supply SA. It is also a long way from Secunda. Mozambique’s massive gas fields in the Rovuma basin are 3000 kms from Secunda. The pipeline costs would be prohibitive. Government has recently resurfaced the 20 year old prospect of Saudi Aramco building an oil refinery in SA. Most oil industry sources believe this is not commercially viable. Shale gas in the Karoo has yet to be found, even if prospecting regulations are sufficiently relaxed to allow prospecting to happen. The alternative is “business as usual” - growing imports and declining integration between the chemical sector and the rest of the economy.

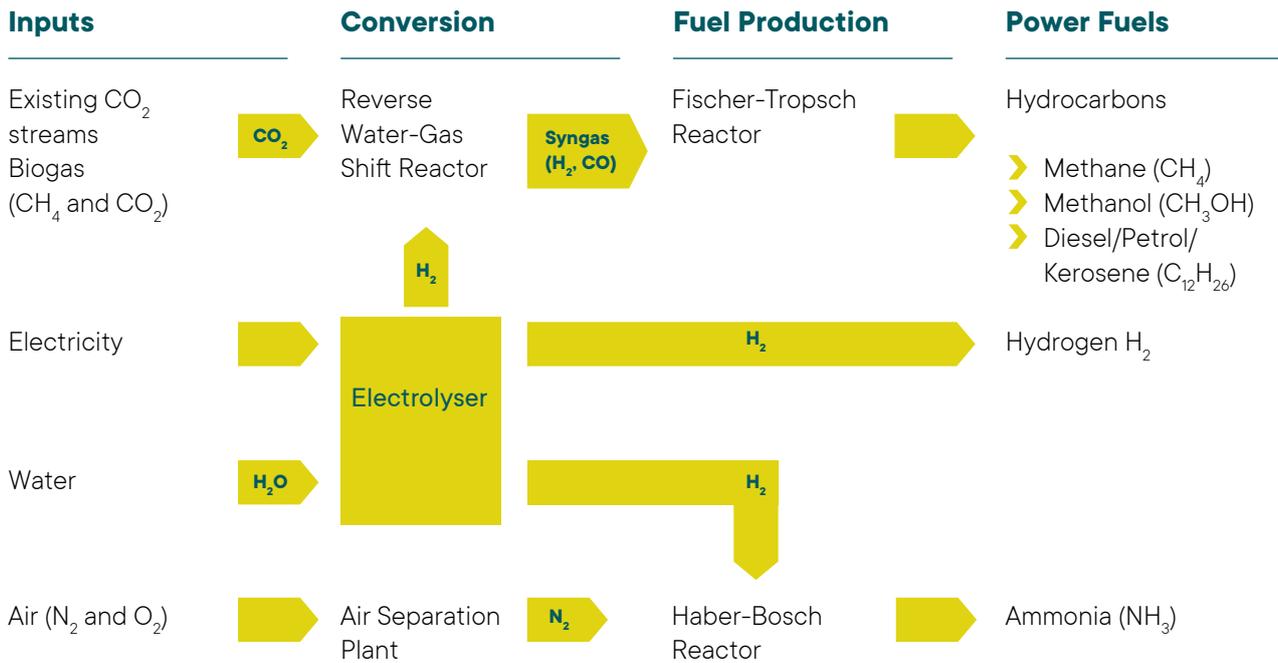
Opportunities

SA has a natural comparative advantage in solar and wind resources which could be used for renewable power generation. It has water resources (oceans on two of its three sides) and high levels of carbon dioxide (CO₂) emissions. In addition, Sasol has advanced Fischer Tropsch technology and experience

- a unique advantage. Taken together these constitute an opportunity.

The opportunity is to use cheap renewable electricity to electrolyse water for the hydrogen (split water into hydrogen and oxygen with electricity); capture CO₂, and use Fischer Tropsch technology to combine them into hydrocarbons as represented in Figure 1.

Figure 1: Renewable power to hydrocarbons



Source: Bischof-Niemz, T. and Creamer, T. 2019. South Africa's Energy Transition: A Roadmap to a Decarbonised, Low-cost and Job-Rich Future, Abingdon: Routledge.

This will not expand Secunda's limited slate of petrochemicals but it will give it "cleaner", "greener" feedstocks and a much lower emissions profile, which could suddenly turn it from a high to a low emissions producer, which could suddenly open new markets for it. For example, after many years, Sasol was eventually able to produce acceptable jet fuel. There is considerable international concern about jet fuel emissions leading the European Union to begin introducing requirements for "cleaner", "greener" jet fuel. This may be an export opportunity. The same approach can be applied to Sasol's chemicals production.

Current impediments are the cost of electrolysis, but this is expected to come down as demand grows. SA could shift its platinum lobby-driven hydrogen research funding from *how to use* hydrogen (which SA currently does not have and which will serve other countries) to *producing* hydrogen which would serve SA.

Electricity is emerging as "the" energy carrier of the 21st century, replacing oil in the 20th century. The electricity supply industry globally is undergoing a massive technological disruption. Therein lies an opportunity - chemicals required for the new distributed electricity generation sector that is emerging.

The South African Development Community (SADC) has about a 20 000 megawatts (MW) shortage of electricity. The lack of electricity transmission infrastructure and the shift toward distributed generation is creating a market for batteries. Currently, used electric vehicle batteries (which still have a useful life outside of vehicles) are being imported. SA could target battery manufacture but this would probably need a more sensible and market-orientated approach to electricity supply industry reform.

It is suggested that there is a possible chemical sector growth nexus in low-cost renewable power, a hydrogen economy, cleaner plastics and chemicals, also supplying the emerging distributed power generation and battery equipment sectors.

Who should drive the recommended interventions?

SA is particularly poor at coordinating and implementing policy interventions. Therefore, I am reluctant to suggest it - unfortunately there seems no other way to activate this nexus of opportunity.

A high-level public/private partnership could drive the initiative. Current Department of Science and Technology (DST) research funding could be redirected in partnership with the private sector and Sasol. The departments responsible for electricity and water would need to make changes to policies and regulations. Whoever is going to be responsible for the “just transition” could play a role. Affected local authorities would need to be supportive.

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